630.72
I96b
#142

MOSCOW, AUGUST 1942 EXTENSION BULLETIN NO. 142

Prevention and Control of Poultry Diseases

By

GLENN C. HOLM, C. E. LAMPMAN, PRES MOORE, AND W. B. ARDREY

UNIVERSITY OF ARIZONA
JUL 3 1953
LIBRARY

Healthy Hens—Increased Income

UNIVERSITY OF IDAHO
COLLEGE OF AGRICULTURE
EXTENSION DIVISION
E. J. IDDINGS
Director

Summary

LOSSES from poultry diseases are most effectively controlled by practicing the following basic control measures:

1. Healthy disease-free chicks from selected parent stock.
2. Sanitary brooding quarters separate from old stock.
3. Clean ranges and sanitary range management for growing stock.
4. Separate laying quarters for pullets and old hens.
5. Avoid the introduction of diseases from outside sources.
6. Well-balanced rations for the control of nutritional diseases.
7. Control external parasites—lice and mites.

Pullorum disease is controlled by: (1) Securing chicks from hatcheries conducting a pullorum-control program, (2) through disinfecting of the brooder house before chicks arrive, and (3) preventing introduction of infection through traffic. (Page 5).

Coccidiosis is best controlled through sanitary brooding practices. (Page 11).

Roundworms are most satisfactorily controlled through range rotation. (Page 13).

Tapeworm infestation is prevented by controlling the intermediate host. (Page 13).

The paralysis-leukosis complex is a highly fatal disease for which no effective treatment has been found. (Page 6).

Peritonitis associated with ruptured ovaries is a common disturbance following digestive disorders. (Page 15).

Colds are more prevalent in high producing hens when the ration is inadequate in vitamin A supplement. (Page 9).

Prevention and Control of Poultry Diseases

By

Glenn C. Holm, C. E. Lampman, Pren Moore, and W. B. Ardrey*

MOST inquiries concerning poultry diseases request methods of treatment rather than prevention. Usually when disease has been detected, much damage already has been done; furthermore, such diseases as tuberculosis and paralysis are incurable. The program of disease control here outlined deals largely with preventive measures rather than treatment.

In general, treatment for disease conditions of poultry is not satisfactory. However, treatment for certain parasitic disturbances that cannot always be prevented, such as tapeworms and coccidiosis, should be considered as part of any control program.

Basic Factors in Disease Control

1. Healthy disease-free chicks from selected parent stock.
2. Sanitary brooding quarters separate from old stock.
3. Clean ranges and sanitary range management for growing stock.
4. Separate laying quarters for pullets and old hens.
5. Avoid the introduction of diseases from outside sources.
6. Well-balanced rations for the control of nutritional diseases.
7. Control external parasites—lice and mites.

Maintain Disease-Free Stock

Do not introduce adult stock. The purchase of mature or partially mature stock involves a greater disease hazard than does the purchase of baby chicks. Mature birds often are affected by parasites and infectious diseases.

Eliminate traffic from outside sources. Any visitor or any poultry equipment, such as poultry crates that may come on the farm, should be considered as potential carriers of disease. Poultry buyers, peddlers, or anyone else traveling promiscuously from farm to farm may carry a disease from one flock to another.

Continuous culling necessary. The continuous removal of all cull birds from the flock, from the time the chicks are placed in the brooder house until they are disposed of as old hens, is not only a profitable management practice but also a desirable measure of disease control. Cull birds that are low in inherent vitality are more susceptible to parasitic and infectious diseases. They are often a source of disease which may be transmitted to the more vigorous birds.

Sanitary Practices

Clean, dry brooder house. Every brooder house and all brooding equipment should be disinfected, cleaned, and dried before the chicks

*Glenn C. Holm, Veterinarian, Experiment Station; C. E. Lampman, Poultry Husbandman, Experiment Station; Pren Moore, Extension Poultryman; and W. B. Ardrey, Animal Pathologist, Experiment Station.

arrive (see Cleaning the Poultry House, page 19). The house should be located handy to the dwelling to facilitate regular and systematic attention to the chicks. Dry litter is especially important in the brooder house because dampness promotes the development of coccidiosis.

Do not carry disease to the chicks. The attendant should guard against carrying disease germs on his clothing from adult birds to chicks. An extra pair of rubbers for the attendant kept at the brooder house will help to reduce this hazard. The brooder house should be on the windward side of the laying house and a sufficient distance away to reduce the hazard of tracking contamination and to discourage flies from traveling from the old stock to the brooding quarters.

Sanitary feeding methods. The house should be equipped with feed and water utensils in which the chicks cannot walk. All feeds should be fed in hoppers. Baby chicks should be fed as soon as they are placed in the brooder house; otherwise they are likely to develop digestive disturbances from eating litter.

Dry sanitary brooder yards. Chicks should be protected from wet ground that may be contaminated. A concrete yard or wire-floored platform is satisfactory for this purpose. In case the latter is used, the floor should be constructed in panels, using ½ to ¾ inch mesh wire, stapled to 1x4 or 1x16 inch material used edgewise *(Fig. 1)*. The platform should

Figure 1.—A wire-floored platform in front of the brooder house is satisfactory for the early brooding period. The floor is made in sections.

be at least 18 inches above the ground. Waste material and droppings should not be allowed to accumulate under the floor as it tends to draw flies and thus increase the tapeworm hazard.

Range Sanitation

A clean poultry range is free from parasite eggs and soil-borne disease organisms and has had no poultry or poultry droppings on it the

previous year. A systematic rotation of ranges used for young chickens is necessary to prevent contamination with soil-borne organisms.

Use the range efficiently. Pullets may be induced to use the entire range by the frequent moving of hoppers and other equipment, to clean areas. All feed should be fed in hoppers. Shade, if artificial should be moved with the other equipment. The commercial poultryman should not congest the range by putting broiler cockerels on it. Vigorous culling of all underdeveloped or sickly appearing birds will assist in preventing the spread of disease.

Breeding and Management Reduces Laying Flock Mortality

Laying flock mortality has been a serious problem during recent years. Many of the diseases responsible are of such a nature that no cure or treatment is effective. A typical example is the paralysis-leukosis complex. Some of the major causes include: (1) the promiscuous use of pullets as breeding stock, (2) the lack of a definite breeding program involving the use of proved breeding stock with respect to livability of progeny, (3) the widespread dissemination of disease by introducing mature stock and exchange of poultry, (4) improper development of pullets, (5) nutritional deficiencies, (6) reduced resistance due to parasitic infestation, and (7) the presence of a specific infectious disease.

Infectious Diseases

Pullorum disease (bacillary white diarrhea)

Chicks affected with pullorum disease may or may not have a diarrhea. Most chicks that die have a retained yolk sac and many of them have gray spots in the lungs and liver. Chilled or overheated chicks show symptoms similar to those shown by chicks affected with pullorum disease. The only method of determining positively that chicks are affected with pullorum disease is by a bacteriological examination.

Pullorum disease is transmitted from infected hens through the egg to the chick. It is spread in the incubator at hatching time, in chick boxes, and in brooder houses. The infection may be prevalent in the brooder house because of improper disinfection, or it may be introduced from older birds by the caretaker. The disease appears when the chicks are about 4 to 6 days of age; the peak in the death rate is reached at about 12 days. The mortality varies from 10 to 50 per cent in Leghorns to as high as 80 per cent in the heavy breeds.

There is no specific treatment for this disease, but rigid culling and sanitary brooding are the practices advised. Frequent changing of the litter and disinfection of feeding utensils are advocated. Antiseptics or other medicines in the water or feed have not proved to be practical or advantageous. The introduction of this disease usually can be prevented by: (1) securing chicks from hatcheries conducting a pullorum-control program, (2) thorough disinfecting of the brooder house before chicks arrive, and (3) preventing introduction of infection through traffic.

Sources of chicks. A program of testing breeding stock for the purpose of eliminating infected individuals is the method by which this disease is controlled. The chick-buying public is best safeguarded by purchasing chicks from hatcheries known to be conducting a pullorum-control program.

Testing for pullorum disease. Eradication of pullorum disease may be accomplished by repeated tests at 1- or 2-month intervals with elimination of reactors until two 100 per cent consecutive negative tests have been obtained. A single annual test with removal of reactors will not completely control the disease.

Three testing methods are used for the elimination of carrier birds: (1) the standard laboratory tube test, (2) the rapid serum test, and (3) the rapid whole-blood field test. The rapid whole-blood field test has merit in a control program but should be followed with a standard tube test as a means of establishing 100 per cent clean flocks. The technique for performing the rapid whole-blood test is given in U. S. Department of Agriculture *Miscellaneous Publication No. 349.*

Pullorum disease is becoming more prevalent in turkeys. One source of infection has been the practice of hatching poults and chicks in the same incubator and hatchery. Another source is the common traffic between turkeys and chickens. Turkeys that recover from the infection usually become carriers. The same general methods of control and eradication outlined for chickens apply to turkeys.

Paratyphoid

Paratyphoid infection is in many respects similar to pullorum disease. Low vitality, due either to nutritional deficiencies or to poor brooding conditions is the major predisposing factor. The agglutination test used for pullorum disease will detect most of the adult carriers of this infection. Blood testing, good brooding, and proper feeding practices constitute the only satisfactory methods of control. Paratyphoid is also one of the most common diseases of poults.

Chick bronchitis

This is a virus disease affecting young chicks. The causative agent is distinctly separate from that causing laryngotracheitis in adult birds although the symptoms are in general similar. The disease occurs more commonly in chicks brooded in batteries and is, therefore, more of a problem in hatcheries than on farms. There is no satisfactory cure for the disease. Thorough fumigation of brooder rooms and equipment is necessary for eradication. After culling and disposal of severely affected chicks, those remaining usually recover if good management is practiced.

Paralysis-leukosis complex

Fowl paralysis is considered to be a form of the general infectious disease complex termed leukosis. The disease, caused by a virus, is essentially a process of tumor cells replacing normal tissues. The symptoms and lesions vary according to the particular phase of the disease and with the tissue or organ affected. The three major phases include: (1) *Paralysis of the leg or wing or both* which results from tumor involvement of the nerves supplying these parts *(see Figs. 2 and 3).* The nerves become enlarged and lose the characteristic cross-striation. This phase of the disease has been called neurolymphomatosis. (2) *A partial or complete blindness in one or both eyes* caused by tumor tissue replacing normal structures. Blindness is preceded or accompanied by a fading and contraction of the iris. This phase has been termed iritis. (3) The *visceral*

type, characterized by an enlargement of any one or several of the visceral organs as a result of either a generalized tumor infiltration or isolated tumor growths. Organs which may be affected include the liver, spleen, kidney, and ovaries. Laying pullets sometimes become extremely emaciated without showing any specific lesions. Growing birds usually develop typical paralysis and blindness while laying birds exhibit a higher incidence of visceral leukosis.

The important points from investigations at the Idaho Agricultural Experiment Station briefly are summarized: (1) The mortality of the infected flock decreases over a period of several years, principally as a

TABLE 1.—Reduction of mortality in the Idaho Agricultural Experiment Station Pedigreed White Leghorn flock by selective breeding (per cent mortality during the first laying year—11-month experimental period).

Year	Total mortality	Paralysis-leukosis complex	Miscellaneous
1933-34	44.6	24.1	20.5
1934-35	37.0	20.5	16.5
1935-36	23.7	9.8	13.9
1936-37	27.9	13.2	14.7
1937-38	17.6	6.9	10.7
1938-39	7.1	2.5	4.6
1939-40	3.5	.9	2.6
1940-41	12.1	2.6	9.5

Note: Above mortality includes unthrifty birds which were culled as well as those that actually died.

result of increased resistance. (2) Visceral leukosis commonly known as leukemia does not decrease as consistently as typical paralysis. (3) Progeny introduced from paralysis-free stock as day-old chicks proved more susceptible than those introduced at 6 weeks of age and older. (4) Progeny from pullet-breeding stock proved more susceptible than those from old hen-breeding stock. (5) Resistance to this disease acquired

Figure 2.—The drooped wing and extended leg shown above are typical postures assumed by birds affected with fowl paralysis.

Figure 3.—Ventral view of the enlarged left sciatic plexus and femoral nerve in contrast to the normal nerves on the right side of the bird.

partly by the natural survival of resistant individuals may be further developed by selective breeding. (6) A decrease in the virulence of infection or an apparent disappearance of the disease complex may be followed later by a recurrence of the disease and some increase in mortality.

Control of paralysis. No worthwhile treatment has been discovered. As a result of experimental work and field observations the following program of control is suggested: (1) In flocks where the disease has become prevalent there should be a program of continuous culling of weak and unthrifty individuals; infected birds should be eliminated as soon as symptoms are detected. (2) Sanitary practices, such as previously described for the control of disease generally, are advised. (3) If paralysis has not been present, its introduction may be avoided by purchasing chicks only from sources free from the infection. (4) If the disease is present, the procedure may be influenced by the kind of flock maintained. In the case of laying flocks it is preferable to secure chicks from parent stock known to have passed through the cycle of infection. In breeding flocks a program of selection should be instituted in which old hens are used as breeders. The pedigree program should be based on the use of progeny from resistant families which have demonstrated a high degree of resistance to paralysis.

Infectious laryngotracheitis

Infectious laryngotracheitis, often called contagious bronchitis, is not common in the state of Idaho. Therefore, every precaution should be observed to prevent its introduction. It is an acute contagious disease which is most often introduced by the addition of adult stock. The common symptoms are sneezing and gasping for breath. None of the ordinary

treatments have proved satisfactory. Control consists of complete elimination of all infected birds. This should be followed by thorough disinfection of houses and equipment and vaccination of all susceptible birds. There must be absolute proof, however, that the disease is laryngotracheitis before birds are vaccinated since vaccination may introduce the disease into the flock. It is unlawful to use live vaccines in Idaho without permission from the Director of the Bureau of Animal Industry.

Fowl pox

Fowl pox usually occurs in laying pullets. The lesion most commonly seen is a yellow vesicle or blister that develops on the comb or wattles. These vesicles soon rupture and a black elevated wart-like scab appears. The eyelids may be involved in some outbreaks of fowl pox and cankers may develop in the mouth. This latter condition is Avian diphtheria and often is confused with nutritional roup.

Vaccination. If the disease is detected early, all birds not already affected should be vaccinated. Birds that are in production may be thrown into a molt by vaccination but usually return to normal production in a short time. In communities where fowl pox is prevalent, all susceptible birds should be vaccinated before they come into production.

Tuberculosis

Avian or fowl tuberculosis spreads rapidly in birds that are allowed to run in contaminated yards. The most common method of introducing tuberculosis is through the purchase of mature or partially mature birds from infected flocks. An effective sanitary program will eliminate this disease in one season. All old birds should be sold and the laying house thoroughly cleaned and disinfected before the pullets are brought in from the range.

Tuberculosis can be detected by a tuberculin test or by the symptoms and lesions of the disease. Tuberculous birds usually do not show marked symptoms until they are approximately 1 year old. At about that age birds will be noticed "going light" or an occasional bird may become lame. The characteristic lesions consist of distinct elevated yellowish spots in the liver and spleen and in some cases along the digestive tract *(Figure 4)*. These elevations vary in size from a pin head to that of a marble. There is no specific treatment for this disease. Prevention is the only method of control. More specific information will be found in U. S. Department of Agriculture Farmers' Bulletin No. 1200 and U. S. Department of Agriculture Leaflet No. 102.

Colds (coryza) and roup

The common cold (coryza) is a contagious disease, the exact cause of which is not definitely established. It involves an inflammation of the respiratory passages of the head, which results in watery eyes and a nasal discharge. Severe colds often develop into infectious roup. Colds usually are spread by carrier birds or by susceptible individuals coming in contact with houses or equipment previously contaminated by infected birds. Individuals become more susceptible when they are low in vitality as a result of parasitic infestation, when the ration is deficient in vitamin A, or when the housing conditions are drafty, damp, or too stuffy.

Figure 4.—Tuberculosis of the liver, spleen, and intestines of a yearling hen. The light spots in the liver and spleen (1 and 2) are tubercles. Tubercles of the intestines (3) open into the bowel and scatter the germs of the disease.

Preventive measures include: (1) the housing of pullets separate from old hens, (2) thoroughly cleaning and disinfecting houses before the pullets are moved in, (3) good housing conditions—proper ventilation, freedom from drafts and sudden changes in temperature, and (4) avoiding debilitating influences such as deficiencies in the ration and parasitic infestations.

There are two types of roup common in poultry, infectious and nutritional. Infectious roup usually follows an outbreak of colds and develops more rapidly if nutritional roup is a predisposing factor; it may be differentiated from the nutritional form by the presence of an offensive odor which is associated with the infectious type.

Treatment for infectious colds and roup consists in correcting the improper feeding and management practices, adding an abundance of vitamin A to the ration, isolating the infected birds, and using a mild laxative (see page 19). Ordinary soda may be given in the drinking water at the rate of 1 tablespoonful to each gallon of water for several days as an alkalizing agent.

Guaiacol-iodine—tablets, powder, or liquid—used in the drinking water is an effective treatment for colds in poultry. The drug and directions for using it may be obtained from a veterinarian. Individual birds, suffering with severe roup or chronic colds, constitute a menace to the rest of the flock and should be killed and burned. For nutritional roup see page 17.

Parasitic Diseases

Coccidiosis

Coccidiosis is an inflammation of the digestive tract caused by a single cell animal parasite. Several species of coccidia attack birds; consequently, the location and severity of the lesions depend upon the type of parasite present.

Coccidia multiply in the digestive tract and eventually produce oocysts or egg-like forms. These eggs pass out of the digestive tract, come in contact with the air, and embryonate. The embryonated oocyst is the infective stage. The egg becomes infective in 24 to 48 hours after being eliminated in the droppings. A complete cycle consisting of embryonation, ingestion, intestinal invasion, and oocyst production can be completed in 2 weeks. A single infestation with coccidia produces a partial immunity, while repeated ingestion of infective eggs produces severe lesions. Therefore, if through daily changing of the litter, birds can be prevented from reinfesting themselves for 1 to 2 weeks, the disease can be controlled.

The ceca and the small intestines are the two regions of the digestive tract most commonly attacked. Birds up to 3 months of age may develop any one of the types, but the cecal form is most common. Laying pullets and older birds usually have the type which attacks the small intestine.

Cecal coccidiosis is more of a hazard when the chicks are allowed on wet, contaminated ground or when they are exposed to wet, chilly weather. They are especially susceptible to adverse conditions after the heat in the brooder has been eliminated. Debilitating factors cannot in themselves produce coccidiosis; the bird must have access to infective material.

Young birds that are affected lose their appetite, have ruffled feathers and drooping wings, and stay under the hover. In advanced stages the

Figure 5.—Cecal coccidiosis of 3-months-old pullet. This is the type of coccidiosis commonly encountered in the brooder house and on the range. One ceca has been cut open to show the blood content.

droppings are tinged with blood. An autopsy will show the ceca or blind intestines to be filled with blood or a blood-tinged plug *(Fig. 5)*.

Intestinal coccidiosis, as previously stated, is more common in laying pullets and adult birds but it occasionally may be present in chicks. The intestine is enlarged and inflamed. Hemorrhagic areas are present and the intestinal wall is thickened. The intestine may be partially filled with a liquid blood material in acute cases. This blood is partially digested before it passes from the bird; therefore, free blood is not found in the droppings of birds affected with this type of coccidiosis. The droppings are watery and the birds exhibit a diarrhea. Older birds usually recover but may continue as carriers of the disease.

Coccidiosis usually is carried to the chicks by the caretaker from old hens or through contact with contaminated feed, yards, or ranges.

The disease may be satisfactorily controlled if treatment is started early. This program consists of: (1) treating the birds with a flush mash, (2) frequent cleaning of litter to eliminate reinfestation, and (3) segregating or killing severely affected birds.

Treat the birds with a flush mash. This treatment consists of supplying the birds with a flush mash for a period of 4 to 5 days.

A satisfactory way to prepare the flush mash is by adding powdered milk to the regular mash until the milk content is increased to 20 or 25 per cent. This mash should be kept before the birds continuously, and no scratch feed should be fed during the period of treatment. An abundance of water should be available since the birds will drink approximately three times the normal amount during this heavy milk feeding.

Dried whey has proved to be a satisfactory substitute for dried milk in the flush mash in trials recently conducted at this Station. The whey, used at levels of 10 to 12 per cent, produced results comparable with dried milk used at 20 to 25 per cent.

The house should be cleaned each day and new litter supplied. Where it is impossible to confine the birds to the house during the treatment it is advisable to move the birds and the house to a clean range. Any number of schemes may be devised to assist in controlling this disease. The main points to keep in mind in prevention as well as in control are: (1) do not permit infective material to contaminate the environment of the chicks, (2) change the litter frequently, (3) keep the birds in a dry house and off wet ground, and (4) use every precaution possible to prevent the birds from coming in contact with droppings.

The continued or intermittent feeding of large quantities of milk will not prevent coccidiosis, and furthermore, reduces the value of the milk flush as a treatment.

Blackhead (enterohepatitis)

This parasitic disease primarily affects turkeys but has been reported occasionally in chickens. As its scientific name indicates, the disease injury is found in the intestine and liver. The ceca shows ulcer formation with varying degrees of severity. The liver has degenerative changes that are quite characteristic. The lesions look like concentric ulcers, one around the other. The color of these spots varies and the size of the area depends somewhat on the duration of the disease.

The protozoan which causes this disease is carried by the common cecal worm. This disease can be controlled in turkeys by preventing traffic between turkeys and chickens. Phenothiazine has been recommended by some as a treatment for cecal worms in chickens and turkeys. It has not been advocated as a cure for blackhead. The Idaho Agricultural Experiment Station has not made studies on this drug.

Roundworms and cecal worms

Birds become infested with round and cecal worms through contact with contaminated yards and ranges. Occasionally birds become so heavily infested that they stop growing, become pale about the head and legs, show poor appetites, have slow feather growth and a generally unthrifty condition. Large roundworms, if present, will be found in the small intestine (*Fig. 6*), while the ½ inch cecal worms are found in the blind intestine. Affected flocks should be culled vigorously and then treated for roundworms. There is no necessity for an annual treatment of birds for roundworms because infestation can be prevented by following sanitary brooding practices and by rotating the pullet range. Roundworms (ascarids and cecal worms) have been entirely controlled in the Idaho Agricultural Experiment Station flock during the past 6 years by following this procedure. If, however, pullets or old hens are known to be infected, they may be safely treated if they are not in production.

Treatment for roundworms. Nicotine sulphate is the most satisfactory drug for roundworm treatment. This treatment consists of four main steps: (1) fast the birds for 18 hours, (2) after the fast give each bird, 3 pounds or over, one hen-sized nicotine sulphate capsule (smaller birds should receive a pullet-sized capsule), (3) following this treatment, give Epsom salt as recommended on page 19, and (4) clean the dropping boards and floors the following day to remove all worms and worm eggs that have been eliminated. Specific information regarding the treatment of birds in production may be secured through correspondence with the Extension Division or College of Agriculture.

Phenothiazine has been recommended by some as a satisfactory treatment for cecal worms.

Tapeworms

Birds affected with tapeworms show symptoms similar to those with roundworms. The tapeworm is a flat segmented worm, the head of which becomes attached to the lining of the small intestine. The presence of tapeworm segments in the droppings is readily detected by an experienced observer. A clean range will not insure freedom from tapeworms although it is worthy of practice. Tapeworms are not contracted by birds directly from tapeworm eggs, but indirectly through an intermediate host such as the house fly, the garden slug, the dung beetle, or the angleworm. These must have become infested with the cystic form of a poultry tapeworm through contact with poultry droppings containing the eggs. Since these intermediate hosts may travel considerable distances through the air, on the ground, or in running water, serious difficulty is experienced in rearing pullets free from tapeworms once they become prevalent on the farm or in a community. Birds infested with tapeworms should be treated before they come into production.

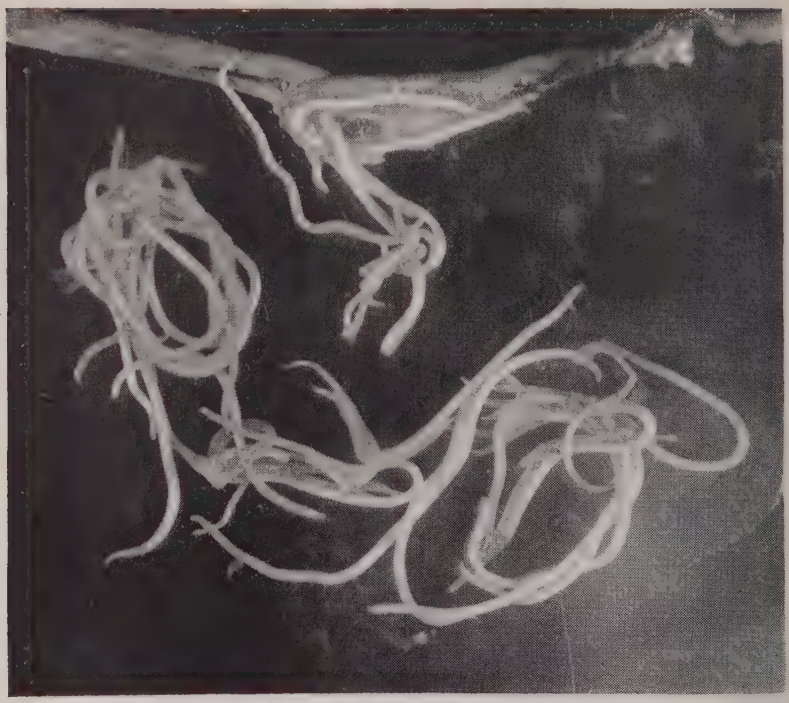

Figure 6.—Roundworms (ascarids) lie free in the small intestines. Worm eggs pass out with the feces and infest material with which they come in contact.

The major factors in controlling tapeworms consist of: (1) breaking up the contact between flies and other intermediate hosts and droppings by storing the droppings in a fly-proof pit; breaking up the contact between flies and birds by the use of fly screen on window openings of poultry houses when birds are kept in confinement; (2) worming the pullets before they start to lay, and old hens while they are in the molt; (3) using dry ground to discourage the presence of intermediate hosts; (4) employing measures that will discourage flies from traveling from old hens to growing stock (such as brooding on the windward side, and as far as possible from the laying quarters).

Treatment for tapeworms. Kamala is the most common drug used in the treatment of tapeworms and has been found in trials of this Station to be most effective. The Kamala should be fresh since it loses its potency with age. It is not recommended as a general flock treatment while the birds are in production.

Treatment with Kamala consists of three essential steps: (1) All birds to be treated must be fasted for at least 18 hours. (2) After the fast each bird weighing over 3 pounds should be given individually one capsule or one tablet containing one gram of Kamala. Pullets weighing 1 to 3 pounds should receive one-half gram doses. Treated birds may be

fed 3 to 4 hours after treatment. (3) The dropping boards should be cleaned and the litter changed 2 or 3 days following treatment. This material will contain large numbers of worm segments which are a potential source of danger and should be stored in a fly-proof manure pit or burned.

When birds are found to be infested with tapeworms during the laying season, those out of production may be treated with Kamala. It is better to defer treatment until the birds molt than to throw them out of production with some drastic treatment.

Lice

There are several species of lice, all of which spend their entire life cycle on the bird. The more common types of lice can be found in the fluff or near the vent. Lousy birds never give their maximum production. Lice can be controlled by painting the roosts with a nicotine sulphate product 15 minutes before the birds go to roost. The pens should *not* be closed tightly after this treatment or the birds may be overcome by the fumes. Birds also may be treated individually with sodium fluoride or blue ointment.

Mites

The common red poultry mite does considerable damage to birds in the laying house, causing loss in egg production and reduced vitality. This mite is found in the cracks and crevices around the roosts and, occasionally, in the nest boxes. It remains on the bird only long enough to feed—usually at night. This pest can best be controlled by thoroughly cleaning the house, described under *Cleaning the Poultry House*, and then painting the infested areas with pure carbolenium, crude creosote, or any wood preservative. When none of these are availible, old crank case oil can be employed. Feather mites, scaly leg mites, and other mites are described in U. S. Department of Agriculture Farmers' Bulletin No. 801, *Lice and Mites of Poultry.*

Miscellaneous Diseases

Peritonitis associated with "ruptured egg yolks"

Peritonitis is an inflammation of the lining of the body cavity, and is most commonly associated with ruptured ovaries. This condition occurs only after birds have come into production. In acute outbreaks the birds exhibit a dejected appearance, become limp, and die suddenly. Their combs turn dark and become shrivelled. In less severe attacks the birds go off feed, become emaciated, but usually recover. Observations made at this Station have shown that tumors of the ovaries, liver, or mesentary (the fold which holds the intestines in place) are many times associated with chronic peritonitis. Upon autopsy, yolk material usually is found in the body cavity, either in a liquid form adhering to the various organs or as a hardened compact mass.

Various organisms have been suggested as the cause of this disease but it has been observed at this Station that it is usually the result of some predisposing factor which causes a sudden interruption in egg production. Digestive disturbances, due to the toxic effect of unwholesome feeds, insanitary quarters, sudden fright, rough handling, or the presence of some infectious disease, are the most common predisposing causes.

No specific treatment is known; however, a mild flush mash containing 20 to 25 per cent dried milk or 10 to 15 per cent dried whey for 3 or 4 days is recommended. Good management practices such as the correction of factors responsible for the sudden drop in egg production will help to prevent this disease.

Enteritis

Enteritis is an inflammation of the intestinal tract. In the mild form there is an accumulation of mucus in the subacute form a sloughing of the mucous membrane and a thickening of the intestinal wall. The acute form shows definite ulcers, hemorrhagic areas, and bleeding. Enteritis is not considered to be a specific disease. It is ordinarily the result of digestive disturbances caused by parasitic infestation, bacterial infection, or spoiled feed. Birds affected with the paralysis complex or peritonitis usually have some enteritis. Treatment should aim at the control of the predisposing cause. A mild milk flush should be administered.

Bumblefoot

In this disease the foot of the bird is swollen and inflamed due to bacterial infection. Ordinarily the organism enters the foot through scratches or penetrating wounds. These injuries may arise from scratching on rough surfaces, among sharp particles of litter, or from jumping from high roosts and nests.

Since high egg production reduces a bird's resistance to infection, the ration should be well fortified with vitamin A. Occasional cases of bumblefoot are common and are probably brought about by simple injury. Bumblefoot may develop into a general flock infection. In such cases there is a possibility: (1) that there is a vitamin A deficiency, (2) that the organism causing the disease has gained virulence or (3) that mechanical factors producing injury are more common.

The abcess should be opened when the area becomes soft. Mild disinfectants should be used to wash the wound and abcess cavity. When the entire flock is involved the condition can best be treated by correcting possible deficiencies, removing or correcting materials that may produce mechanical injury and, if possible, isolate affected birds.

Cannibalism

Cannibalism in the laying flock is usually a carry-over of a habit that was developed during the brooding period. It is likely to develop among chicks if they are allowed to become restless under congested conditions. Overcrowded, overheated houses, too close confinement of chicks to brooder house, lack of green feed, and an irregular feeding program are some of the more common causes. The first case starts accidently in most instances during the stage when the main tail and wing feathers are soft and filled with blood; after blood is drawn the trouble spreads rapidly. It is suggested, therefore, that measures of control begin with the management of chicks during the brooding period.

Sometimes the trouble starts in the pullet flocks as the result of some bird accidently picking and drawing blood on some of the exposed tissues such as the comb or vent, or from the quill of new feathers; occasionally

cases of "blowouts" (eversions of the oviduct) often starts a "pickout" siege.

Extreme difficulty is experienced in effectively controlling any form of cannibalism, especially pickouts, once the birds have developed the habit. Picked birds should be removed from the flock at once and treated by the application of some "no-pick" preparation. There are commercial preparations on the market, some of which are quite satisfactory. A simple preparation has been developed at this Station which has proved quite satisfactory. A small amount of iodine and any coal-tar disinfectant or Black Leaf 40 is thoroughly mixed into axle grease.

Pullets should be moved into the laying house before they come into production and should be encouraged to lay in the nests. Feeding whole oats and meat meal in separate hoppers temporarily, in addition to the regular ration, will sometimes help to relieve the danger of cannibalism.

Nutritional Deficiency Diseases

There are four major nutritional deficiency diseases which are likely to interfere with the normal health of the bird. The prevention of these deficiency diseases is a matter of supplying balanced rations.

Vitamin A deficiency

A lack of vitamin A results in poor growth, reduced vitality, and increased susceptibility to infectious diseases. The typical symptoms as illustrated in picture Number 1 of Figure 7 consists of watery eyes, unsteady gait, ruffled feathers, poor growth, and pale shanks. In extreme cases the proventriculus, kidneys, and ureters are enlarged.

In adult birds the symptoms are in general similar to those exhibited by chicks. Advanced cases are more likely to show small white abcesses or "pustules" covering the mucous membrane of the throat and esophagus. This condition is commonly known as nutritional roup and is often a predisposing factor of the contagious form of roup.

Adequate vitamin A supplements, particularly fresh greens, alfalfa meal of good quality, and the fish oils as recommended in Idaho Extension Bulletin No. 125, *Poultry Rations*, will prevent this condition.

Vitamin D deficiency

A lack of this vitamin results in a type of leg weakness known as rickets. In advanced cases the bird is unable to stand or walk normally *(see picture No. 2 in Fig. 7)*. The bones become soft and are abnormally low in ash. A lack of this vitamin also results in crooked keels, thin-shelled eggs, and poor hatchability of eggs. The natural source of the calcifying agency is the ultraviolet rays of direct sunshine. In modern feeding practices it is supplied through the use of fish oils and other newly developed vitamin D concentrates.

Vitamin G deficiency

The lack of this vitamin is illustrated in picture Number 4 of Figure 7. The typical symptom of this deficiency in growing chicks is "curly-toe" paralysis. Other symptoms include slow growth, ruffled feathers, and general unthriftiness. A lack of this vitamin in the ration of breeding stock results in a marked reduction in the hatchability of eggs.

In poults the deficiency results in scab-like sores in the corners of the

mouth and about the eyelids. The bottoms of the feet sometimes become sore caused by a roughening of the skin and cracking of the flesh at the joints. The sources of vitamin G consist of the fresh greens, good quality dried alfalfa and dried milk products. The use of these products is discussed in detail in Idaho Extension Bulletin 125, *Poultry Rations.*

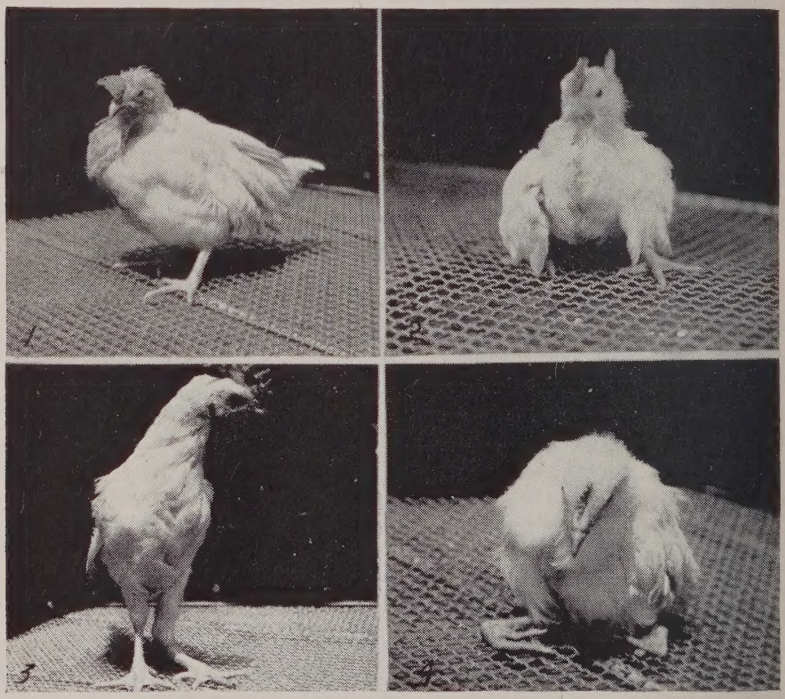

Figure 7.—Common nutritional deficiency diseases in growing chicks. 1.—Vitamin A deficiency. 2.—Rickets due to lack of vitamin D. 3.—Perosis, or slipped tendons. 4.—Curly toe paralysis due to a lack of vitamin G (riboflavin deficiency).

Perosis

This condition, often referred to as "slipped tendons," is illustrated in picture Number 3 of Figure 7. The tendons twist to one side of the hock joint so that the shank becomes twisted and the entire joint enlarged and flattened. This condition may occur as the result of a deficiency of manganese or an excess of phosphorus. Recent investigations have shown choline to be another factor concerned in this particular deficiency.

Other nutritional deficiencies

Of the several other specific deficiency diseases known, there are two that may occasionally be found. A lack of pantothenic acid, commonly known as the filtrate factor, causes scabs at the corner of the mouth and on the feet of chicks. This factor usually is supplied in the same feed stuffs that furnish riboflavin and is furnished to some extent by grains.

A lack of vitamin E has been found to produce the symptoms formerly called "crazy chick" and more recently designated as encephalomalacia. Chicks suffering from this deficiency go into convulsions and assume a posture in which the head is thrown back and the feet stuck out in front. Inasmuch as this vitamin is supplied in whole grains and mill feeds, it is not likely to be a problem unless degerminated grains are used extensively in the ration.

Poultry Laxatives

The most common laxative for chicks during the brooding period is additional milk or whey in the diet for a period of 2 or 3 days. It is best added in the powdered form. The mash should contain 20 per cent dried milk or 10 per cent dried whey, and the grain should be eliminated during the period of treatment. Fairly satisfactory results also can be obtained by the use of skim milk or buttermilk as the sole drink for a similar period.

In the case of laying stock, there are certain occasions when it is desirable to extend the laxative effect for a period of 3 to 5 days. This can be accomplished by following the Epsom salt with a milk flush mash as described heretofore. During the treatment the scratch should be restricted to a light feed at night.

For older birds, that is, birds on range and in the laying flock, Epsom salt usually is satisfactory as a laxative. It is used at the rate of 1 pound to each 500 pounds of chickens or for hens at the rate of ¾ pound to each 100 hens. It should be given in the morning in the amount of drinking water that will be consumed during the forenoon. The flock should then be supplied with plenty of fresh, clean drinking water.

Cleaning the Poultry House

Every poultry house should receive annually at least one thorough cleaning. This includes (1) the elimination of all dirt, (2) disinfection of the house, and (3) application of materials for ridding it of insect pests, particularly mites. The brooder house should be cleaned and disinfected before the chicks arrive, and the laying pens just prior to the time the pullets are housed. It is impossible to clean thoroughly a house with a dirt floor. Concrete or board floors are essential for cleanliness.

Removing dirt. A thorough job of cleaning requires the removal of equipment, litter, dirt, and dust. All surfaces should be swept and scraped until they are absolutely clean. The floors, dropping boards, side walls, and equipment should then be scrubbed with boiling hot lye water, using one can of lye to 10 gallons of water. The lye not only cuts the dirt but is a good disinfectant.

Disinfecting the house. After the house has been allowed to dry it should be thoroughly sprayed with a good disinfectant such as a 5 per cent solution (1 pint to 2½ gallons of water) of cresol or one of the standard coal-tar products. Bichloride of mercury or chlorine disinfectants are not recommended for this purpose since they rapidly deteriorate when they are in contact with organic matter; furthermore, bichloride of mercury is very poisonous. Further information concerning disinfectants may be obtained from Farmers' Bulletin No. 926, U. S. Department of Agriculture, *Some Common Disinfectants.*

COOPERATIVE EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS OF THE STATE OF IDAHO UNIVERSITY OF IDAHO COLLEGE OF AGRICULTURE AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

POULTRY SECTION

Printed and distributed in furtherance of the purposes of the Cooperative Agricultural Extension Service provided for in Act of Congress May 8, 1914.

R. G. BAILEY PTG. CO. 2 LEWISTON, IDAHO